

AN OVERVIEW OF MINERAL RESOURCES DEVELOPMENT IN NIGERIA: PROBLEMS AND PROSPECTS.

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ABSTRACT

Nigeria is endowed with numerous Mineral Resources such as cassiterite, columbite, lead, Gold, Barite, gypsum, bitumen, coal etc. The processes of Nigeria's mineral development however, greatly affects the environment largely due to the fact that most of the mining activities are carried out by artisanal and small scale miners who lack appropriate technology and sufficient funds, and are reluctant to imbibe best practices in their operations. While the enormous Mineral deposits portray potentials for industrial and technological development, the manner in which the resources are exploited portrays great danger for the communities where the resources are found. In Zamfara, North Western Nigeria where active mining of gold, lead and other minerals is going on, the indiscriminate manner in which the activity is carried out has led to the death of about 300 people as a result of lead poisoning of shallow water sources and soils. Similarly, on the Jos Plateau, North Central Nigeria where mining of cassiterite and columbite took place, a total of 2,015 disturbances are recorded in the form of abandoned mine ponds, mine dumps and lotto's, just as over 3000 oil spillage are recorded in the Niger Delta within a period of 4 years, resulting in the destruction of over 6000 fish farms. The Environmental challenges of mineral development though numerous and challenging, can be addressed through the development and enforcement of an appropriate environmental management plan for all phases of the project life cycle.

KEYWORDS; Mineral Resources, Mining, Exploration, Environment, Artisanal and Small Scale Mining

INTRODUCTION

Nigeria is endowed with enormous mineral resources which when properly harnessed can lead to its industrial development and prospects. It is a known fact that countries abundantly endowed with mineral resources become great industrial nations (Okpanachi, 2004). While on the other hand, the level of greatness of a nation is often a reflection of how its resources have been planned, managed and utilized (Gotan, 2004). The occurrence of mineral resources in commercial quantities alone does not however guarantee optimum benefit, factors such as technological capacity, finance and market are also equally important.

Nigeria is blessed with abundant mineral resources and human resources capable of tapping these resources for industrial growth, however, what is witnessed today is that most of the mineral development, especially the exploitation is done by informal and in most cases illegal miners using very crude techniques with no consideration for the environment or human health. The Ministry of Mines and Steel Development has identified and is promoting the development of 34 mineral resources in Nigeria which include iron ore, gold, coal, tantalite, bitumen, limestone, barite, gypsum, kaolin (MSMD) etc. The importance of mineral development of any nation cannot be overemphasized as it is one of the sources of industrial raw material supply, what must however, be emphasized is the manner in which the resources are developed.

JUSTIFICATION

Nigeria is endowed with numerous mineral resources which are at various stages of development. Most of the development however is done by informal and artisanal miners who lack the appropriate technology and funds to carry out the exploitation in a sustainable manner, as result they leave behind a devastated landscape which adversely affects the various environmental media and its resources like water, soil and food crops as well as the health of humans and animals. This study is a review of the mineral resources of Nigeria, its level of development and prospects, as well as the problems of the sector with a view to making recommendation as to the way forward.

OBJECTIVES

The main objectives of this study are,

- I. Highlight the mineral resources potentials of Nigeria
- ii. Highlight the prospect and level of mineral resources development in Nigeria
- iii. Enumerate the problems associated with mineral development in Nigeria
- Iv. Make appropriate recommendations as to the way forward

METHODOLOGY

This paper is a result of desk study of relevant journals, conference and seminar papers and other interactions on solid minerals, as well as personal knowledge and experience of the authors. The interactions of the authors with key players in the private, public and academic sector of the minerals industry was also of immense benefit in putting this work together.

GEOLOGICAL SETTING

Nigeria has a large land area of about 924 square kilometers with a terrain that is very variable, with Mountains in the South East, Hills and Plateaus including the Jos Plateau in the centre, lowland in the South, and plains in the North. Nigeria's climate varies from Equatorial in the South to Tropical in the Centre, and Arid in the North. Annual rainfall varies from over 4000mm in the South to less than 250mm in parts of the North, with a national average put at 1180mm. The rainfall is characterized by two seasons, the wet and the dry season. The wet season usually occurs between April to October, while the dry season is from October to March. Nigeria is a large country within the African continent, and it is structurally stable (Adegbesan, 2006). About one half of the nation's surface area is underlain by crystalline basement rocks as can be seen in the South west (Lokoja – Abeokuta – Babana), South east, and North Central.

These basement rocks include mostly metasediments along with amphibolites and metamorphosed tuffs and volcanic rocks. Bedded iron formations rich in magnetite and hematite also exist in the basement. Other rocks of the basement include older granites, younger granites and tertiary volcanic rocks like basalts and rhyolites. The basement can be divided into the eastern and western provinces where the latter is marked by the occurrence of a variety of metallogenic types and greater development of the supracrustal N-S belts, while the eastern province dominated by Pan African granitoid rocks are a paucity of metallic mineral occurrences (Woakes, *et al.* 1989). The remaining one half of the nation's surface is covered by Mesozoic and younger sediments which occur mainly in sedimentary basins such as Niger Delta, Anambra, Chad, Sokoto embayment and the Benue trough. This favorable geological setting harbors a wide range of minerals which constitute veritable raw materials for diverse industries. Figure 1 shows a simplified geological map of Nigeria.

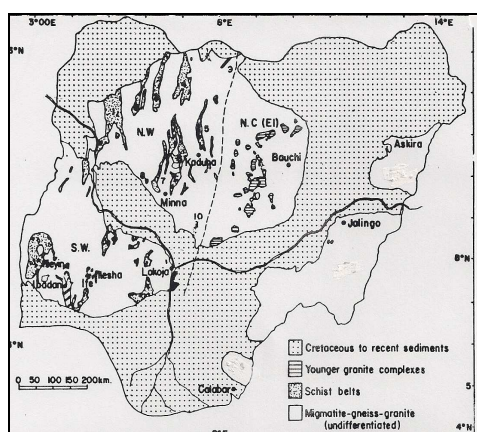


Figure1. Simplified Geological Map of Nigeria (Source: Ajibade *et al.* 1989)

MINERAL RESOURCES

Minerals are naturally occurring, usually solid substances which possess definite or well defined physical and chemical features, shape, structure and chemical composition. They are and will always be the source of wealth for any nation endowed with them. The posterity of any nation is often directly related to the development and utilization of its resources. The minerals in Nigeria's landscape are distributed in all the geopolitical zones of the country and are found to be associated with the major rock types that constitute its geology.

The rock types have produced numerous mineral raw materials such as gold, lead, zinc, tantalite, coal, bitumen, limestone kaolin, etc. The Nigeria geological survey agency classified mineral resources into two broad categories namely – Demand driven Mineral commodities and Mineral commodities suitable for export. A mineral resource is a concentration or occurrence of mineral materials of intrinsic economic interest in or on the earth's crust in such form and quantity that there are reasonable prospects for eventual economic extraction (Ajayi, 2010). Table 1 gives some major mineral resources of Nigeria and their reserve estimates. The mineral industry remains the main source of Nigeria's foreign exchange and provides more than 90% of the country's export value (Kogbe, 1989).

Table1. Occurrence and Reserve Estimate of Some Major Mineral Resources of Nigeria

S/NO	Mineral	Location	Reserves estimates (MT)
1	Barites	Benue, Cross Rivers, Adamawa, Yobe, Nasarawa, Enugu, Taraba State	2,000,000
2	Bentonite	Yobe, Abia, Anambra, Adamawa, Edo, Imo, Ebonyi, Akwa Ibom, Cross Rivers, Benue, Borno State	1,200,000
3	Columbite	Plateau, Kano, Kaduna, Bauchi, Kogi, Kwaara, Nasarawa States	N/A
4	Cassiterite	Plateau, Bauchi, Kano, Cross Rivers, Ekiti, Kaduna, Nasarawa, Taraba States	300,000
5	Coal	Benue, Enugu, Nasarawa, Gombe, Edo, Anambra, Abia, and Ondo States	500,000,000
6	Dolomite	Kogi, Oyo, Edo, Nasarawa, Kaduna States and FCT	16,540,000
7	Marble	Oyo, Edo, Nasarawa, Kogi, Katsina, Niger and FCT	80,292,000
8	Gold	Cross Rivers, Edo, Kaduna, Katsina, Kebbi, Niger,, Osun, Zamfara States	N/A
9	Gypsum	Adamawa, Taraba, Benue, Gombe, Ogun, Imo and Borno States	2,000,000.00
10	Iron ore	Kogi, Nasarawa,	478,000,000
11	Gemstone	Plateau, Bauchi, Yobe, Borno, Ogun, Ondo, Kwara, Kogi and Imo States	
12	Kaolin	Katsina, Plateau, Ogun, Bauchi, Ekiti, Ondo and Anambra States	3,600,000
13	Lead/Zinc	Nasarawa, Plateau, Taraba, Bauchi, Gombe, Ebonyi, Imo, Kano and Benue States	20,000
14	Tantalite	Nasarawa, Kaduna, Kwara, Kogi States	N.A
15	Limestone	Enugu, Cross Rivers, Ogun, Edo, Benue, Gombe, Sokoto, Adamawa, Ebonyi, Imo and Yobe States etc	1,355,980,000
16	Talc	Niger, Osun, Kwara, Kogi, Kaduna States and FCT	40,000
17	Granite	Plateau, Ondo, Ogun, Bauchi, Borno, Adamawa, Kogi, Cross Rivers, Oyo and Imo States	3,000,000.00
17	Salt	Nasarawa, Taraba, Enugu, Cross Rivers, Benue, and Ebonyi States	N/A

N/A –Not available

Source: RMRDC Industrial studies on Base metal, Iron and steel, and Engineering services sector (5th update, 2006), RMRDC Multidisciplinary committee report of the Techno-Economic Survey on Non metallic minerals sector (4th update, 2003), and Malomo, 2007

Development Prospects

Nigeria's mineral resources and mining industry have witnessed several stages of development from the era of traditional mining during which there were no policies or legislation governing the industry (Pre-colonial era) to the era marked by proper documentation of all mining activities in the country, known as the colonial era (Davou and Dung Gwom, 2008). The post colonial era witnessed various government policies and programmes on the minerals sector as well as a high level of instability. This period coincided with the advent of petroleum, and brought about a drastic shift in labour and government attention from the solid mineral industry and agriculture to the petroleum industry, the result of which is a decline in the mineral industry up to 1980 and 1990s when the industry was at the verge of collapse. The Nigeria Government viewed the solid mineral industry as a profit oriented sector, and became involved in exploration, exploitation and marketing of solid minerals as observed by the setting up of the Nigeria Mining Corporation (NMC) in 1973. The Nigeria Mining Corporation could not achieve much as petroleum continued to dominate the mining industry and the National economy (Davou and Dung –Gwom, 2008).

In an attempt to reverse the reliance on petroleum, a bold step was taken to revamp the solid mineral industry through the establishment of the then Ministry of Solid Mineral Development in 1995, which today is known as the Ministry of Mines and Steel development. This ministry is now restructured and a new law, the Nigeria minerals Mining act, 2007, and also a National minerals and metals policy (January 2008) put in place. Similarly several agencies (e.g. the Geological Survey agency and mining cadastre) under the Ministry have been restructured to ensure better performance in the sector. Despite all of this development, the industry is still far from achieving its goals.

The geological survey agency of Nigeria and the ministry of mines and steel development have reported the occurrence of more than 34 minerals in over 450 locations spread across the entire country, which are in various stages of development. Records from the Nigeria Geological Survey Agency and the Mining Cadastral office indicates that as at November 2000, a total of 1265 exploration license (EL) and 88 small scale Mining licenses (SSML) have been issued to mining companies, and they are expected to operate on a combined total of 53 mineral types (Malomo 2007).

Fully integrated mines are a rarity to come by in Nigeria except for some limestone and marble open cast mines and a few dimension stone producing outcrops. Despite this however, Nigeria still has its own share of world class minerals with appreciable reserve tonnages. Table 2 shows development of some industrial and metallic minerals in the country, while table 3 shows the four world class minerals of Nigeria and their inferred reserve figures.

Table 2 Development Status of Some Industrial and Metallic Minerals in Nigeria.

MINERAL	ACTIVE MINE	ARTISINAL MINE
Dimension Stone	10	2
Feldspar	4	6
Gold	7	8
Lead/Zinc	3	-
Limestone	10	2
Marble	9	1
Talc	4	-
Tantalite	3	8
Trona	-	12
Wolframite	1	1

Table3 Nigeria's World Class Minerals and Inferred Resource Figures.

S/NO	MINERAL	INFERED RESERVE
1	Bitumen	27 billion barrels of oil equivalent
2	Coal	1,487 million metric tone
3	Gold	50,000 ounce
4	Barites	12 million metric tonnes

Source: Malomo, 2007

Level of Development

Despite Nigeria's huge resources, development is done mostly by artisanal and small scale miners. Artisanal mining refers to informal activities undertaken by individuals and groups which are heavily dependent on manual labour and using simple implements and methods of exploration and exploitation. The Nigeria minerals and mining act (section 164) defines artisanal mining as mining operations limited to the utilization of non – mechanized methods of reconnaissance, exploration, extraction and processing of mineral resources within a small scale mining lease area.

As earlier stated, except for a few limestone and Marble open cast mines, fully mechanized and integrated mines are hard to come by in Nigeria. The oil industry is an exception as it is multinational in nature and in most cases highly integrated.

Small scale mining is usually undertaken by small legal entrepreneurs/companies. They lack sufficient funds and their operations are under-financed, as a result they do not utilize the potential of their mineral concessions and use the services of manual labour. Virtually all the activities currently carried out in the Nigeria solid mineral industry is by artisanal and small scale miners (ASSM), and about 90-95% of the Solid Minerals in Nigeria are produced by such category of Miners (Ogezi, 2005).

Value addition

The availability of the Mineral resources alone cannot drive the solid minerals sector of Nigeria. It is equally driven by the ability of stakeholders to exploit and market the products to the overall economic benefit of the country. Universal best practices involve value addition to the quality of the raw minerals to attract buyers and increase utilization in the various industries.

Value addition requires laboratory testing, further processing and beneficiation. There are quite a number industries involved in the processing and beneficiation of Nigeria's solid minerals with majority of them in the industrial minerals sub-sector. Several kaolin processing and other industrial mineral processing companies can be seen in Plateau State, such as Kavitetex, monumental kaolin and the Global industrial raw materials company, while Baryte and Bentonite are processed in Nasarawa and Edo States amongst others. The National Iron ore mining company of Nigeria is expected to be the hub of Nigerian Iron ore industry and is saddled with the responsibility of exploiting, mining, processing and supplying of iron ore concentrates to the major steel plants of Ajaokuta and Aladja on annual basis (it is worth mentioning however, that a lot of mineral resources in Nigeria are illegally mined and exported to the international markets with no official records what so ever).

PROBLEMS OF MINERALS DEVELOPMENT

The minerals industry in Nigeria is faced with several problems which include policy inconsistency and lack of adequate legislation, high risk and health hazards, weak regulation, lack of well equipped laboratories, unwholesome practices of stakeholders and inadequate number of trained personnel, access to capital, lack of appropriate technology and machinery, and environmental degradation and pollution.

Policy inconsistency and lack of adequate legislation

Government policies in the Mineral sector over the years tend to be unstable as they come and go with the government of the day. For example, the remarks in 2008 by the Minister for Mines and Steel Development to revoke and revalidate all exploration licenses (ELS) issued by the mining cadastre office are one such instance. Such developments scare away operators and prospective investors due to uncertainty. Similarly, the minerals act of 1999 failed to cater for certain critical aspects of the solid minerals sector and left a lot of room for undue bureaucracy in mineral title administration. It is hoped that the new minerals act signed into law in 2007 will ensure security of tenure; greater transparency in granting access, competitive fiscal terms and encourage an industry led by the private sector.

High risk and health hazard

Because the mineral Sector in Nigeria is mainly driven by the artisanal and small scale miners who embark on low technology and crude/traditional methods in their activities, they are exposed to high risk from obnoxious and dangerous metals such as lead and radio- active waste (Davou and Dung-Gwom,2008; Akaolisa,2006). Manganese value of 0.9mg/l which is higher than the WHO(2006) highest desirable level of 0.05 has been recorded in abandoned mine ponds of the Jos Plateau, while chromium values of 0.1mg/l and 0.12mg/l which exceeds the maximum admissible concentration of 0.05mg/l (Gyang and Ashano, 2010) were also recorded. Similarly, mining methods like lottoing has resulted in several deaths as a result of collapse or accidental falling of human beings and animals into abandon lotto's (Gyang and Ashano, 2010). Similarly, it has been reported that Nigeria recorded a total of 3,203 oil spillages between the years 2006 and 2010 (Odey, 2010), 23percent of which was caused by equipment failure, operational/maintenance error and corrosion, while 45percent of the spill was attributed to sabotage and vandalism. Figure 2 shows some informal miners sinking lotto on a cassiterite mine in Barkin Ladi area of Plateau state.



Figure 2.Lotto Miners at a Cassiterite mining site in Barkin Ladi, Plateau State, Nigeria (taken on 07/06/2010)

Weak Regulation

Activities of the artisanal and small scale miners are proving difficult to curtail by legislation, and Ministry professionals saddled with the responsibility of monitoring their sharp practices are poorly equipped to face the menace. Often times, these operators are armed and desperate. Weakness of the regulations is said to be as a result of the Governments consciousness of the need to allow locals earn their living wages through small scale exploitation of minerals to alleviate poverty (Malomo, 2007).

Lack of well equipped laboratories

There is an apparent lack of well equipped laboratories for conducting test on mineral raw materials, and where they exist, their equipment are often old and outdated, while the few modern and high tech equipment laboratory that exist either lack adequately trained personnel to operate them, or are saddled with problems of inadequate supply and fluctuating electricity levels which sometimes destroy these equipment. Mineral samples are often taken overseas for reliable results.

Unwholesome Practices of Stakeholders

Most gem stone producing mines are artisanal in nature and Won stones are not declared but are hidden to avoid royalty. Such stones are smuggled out of the country to international markets without any value addition, and as such are valued lowly resulting in loses of lots of revenue by the Government and even the marketers themselves.

Access to capital

Access to necessary capital and finance is a big problem to many miners, especially the small scale and artisanal miners. The conditions required for the issuance of loans by banks and the interest rates normally scares away the miners as their conditions are hash. It is hoped that the effort by the Federal government of Nigeria and the World

Bank to give out funds to the tune of US\$120 million to artisanal and small scale miners as a poverty alleviation strategy will address this issue.

Lack of appropriate Technology and Machinery

Artisanal and small scale miners form the bulk of the players in the minerals industry in Nigeria, and they lack sufficient capital to purchase or hire technology and appropriate machinery. This has resulted in the use of crude technology resulting in devastating effect on the environment and even the quality of minerals mined.

Environmental Degradation and Pollution

Mining of minerals in Nigeria has always left behind a devastating effect on the environment. On the Jos Plateau, where active mining of tin and columbite took place, a post mining environment scarred by numerous mine ponds and dams surrounded by heaps of mine spoils and devastated landscape was left behind with a total of 2,015 disturbances recorded in the form of mine ponds, mine dumps, and lotto's in just 3 of the regions where mining took place, and 75 deaths recorded in abandoned mine ponds within the period 1994 to 2008 (Gyang, 2010). Damage to sensitive ecosystems that support fish and wild life, and human health risk from contaminated water sources are a common occurrence as witnessed in Zamfara, North Eastern Nigeria where about 300 people died as a result of lead poisoning of shallow water sources and soils due to gold and lead mining activities (Gusau, 2010), and in Delta State where oil spill from crude oil drilling activities destroyed about 6,000 fish farms (Orubebe, 2010). Similarly, it is on record that in 2005, the about 1.0 billion tons of iron ore, bauxite, arsenic, cadmium, copper, gold, lead, mercury and nickel produced yielded more than 4.0 billion tons of waste material. This is four times more than ore extracted (Rahaman 2010).

CONCLUSION

Nigeria is endowed with diverse mineral resources of very good grade and substantially large quantities to sustain industrial and technological development as well as earn foreign exchange and create jobs. Development in the Nigeria solid minerals sector is however slow despite several attempts by the Government to ensure rapid development in the industry, probably due to the overreliance on crude oil. The huge financial investment involved in setting up conventional medium or large scale mining companies as well as the long gestation period is seen as one of the factors militating against development in the sector, coupled with the fact that local banks are reluctant to give loan facilities, and even when they do, the interest rates are always too high.

Furthermore, policy inconsistencies on the part of the Government scares away foreign investors as there is no guarantee of their investments. The attitude of the artisanal and small scale miners who presently dominate the solid minerals industry leaves much to be desired as they use crude and unconventional methods to extract the mineral resources with severe consequence on the environment and pollution of water sources and soils, resulting in several deaths. Their activities are usually not documented, and in most cases the minerals are exported to international markets illegally, resulting in loss of revenue to the Government.

RECOMMENDATION

Nigeria is blessed with mineral resources which can be harnessed for industrial and technological development to improve the quality of life of the people. The environmental impact of mineral development processes though numerous and quite challenging, can be addressed through the development and enforcement of a realistic and appropriate environmental management plan for all phases of the project life cycle. The Government should ensure consistent and business friendly policies, while at the same time give guarantees and grants to mining companies as is applicable in the agricultural sector. The environmental protection policies and the requirement for environmental assessment under the new Nigeria Minerals and Mining Act should be strictly enforced by the relevant government agencies empowered by law to do so.

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